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Influence of Indoor air pollutants in lower respiratory tract with COPD and people health status in urban Madurai

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ABSTRACT

Chronic obstructive pulmonary disease is a foremost world-wide health issue because of the situation rising incidence, high prevalence, and Social problems on small population (8%) with severe illness. In addition, COPD is frequently associated to diseases such as tumour and heart disease, which have a noteworthy economic impact on publics and society.Cigar, Cigarette and pipe smoking are the further most public causes of COPD. Cigarette smoking is in major cause for about 85% of COPD threat. The threat of emerging chronic obstructive pulmonary disease from tobacco usage differs from person to person. COPD is an illness that disturbs the lungs and airways. Despite this, many emerging countries report great incidences of chronic lung diseases among non-smokers, which may be associated to indoor air pollution produced by solid fuel ignition of country wood in cooking. The main objective of the study is to analyse the Influence of Indoor air pollutants in lower respiratory tract with COPD and people health status in urban Madurai. The collected data was analysed by most popular statistical SPSS tools such as ANOVA, independence t- test and multiple regression techniques. This study used the primary data thatwas collected from 208 COPD patients in Madurai health centres. Our findings evaluated the effect of contaminants on the lower respiration tract status of the COPD patients and also recommended various suggestions to reduce the indoor pollutants for the evolution of healthy future generations.

Keywords: Indoor air pollutants, Chronic Obstructive Pulmonary Disease (COPD), Respiratory tract, Health status, Lung disease

1. INTRODUCTION

Chronic obstructive pulmonary disease (Agusti, Voeimeier et al., 2020) is a foremost world-wide health issue because of the situation rising incidence, high prevalence and very important related economic, social and personal costs. This disease (Agusti et al., 2020) is usually considered as a disease caused to old aged people and self-inflicted by tobacco smoking. But well-versed epidemiological studies proved that 30% of people affected by COPD are non-smokers. It is a varied condition (Wilkinson et al., 2017), caused because of cruelty of airway infection and discrete variation in the environment (Singh et al., 2022).

Blood eosinophil levels and the influence of (ICS) Inhaled Corticosteroids on exacerbations of (COPD) has been connected in randomized measured trials(Long et al., 2020). An exact identification of an insistent respirational infection ends the patient discomfort (Halpin et al., 2022). Misdiagnosis and under diagnosis of COPD is very common. Knowing the infection and finding its signs are essential for analysis. Spirometer is used to measure airflow constraint, which is essential for checking the analysis (Roth et al., 2017). COPD (Diaz-Guzman et al., 2014) is one of the foremost reasons of illness and demise globally. FCV represents Forced Vital Capacity which is the total amount of air exhaled after Forced Expiratory Volume (FEV) test.

In addition, COPD is frequently associated to diseases such as tumour and heart disease, which have a noteworthy economic impact on publics and society. Cigar, Cigarette and pipe smoking are the further most public causes of COPD. Cigarette smoking is in charge for about 85% of COPD threat .The threat of emerging COPD from tobacco use differs from person to person. Even though smoking is the primary cause of COPD, less than 20 percent of chain-smokers grow main airway infection which is not known.Aspects that have been acknowledged as donating to the improvement of COPD comprise exposure to dirt and biochemical constituents in the workstation, particulate substance in the air both inside and outside, smouldering, respirational contaminations, and hereditary predisposition.

Every year, around 3 million publics die from COPD, according to the WHO. The occurrence of COPD in the developed world is mainly recognized to tobacco use. Though, other threat factors are important and preventable donors to COPD, mainly in the emerging world (Decramer et al., 2013). COPD is a multi-faceted syndrome that is affected by a mixture of ecological and hereditary risk factors. Tobacco use is a well-recognized threat factor for chronic obstructive pulmonary disease (COPD), however, there are many other subsidising factors that are often ignored or unnoticed. In fact, up to half of all COPD cases are recognized to non-tobacco-related threat factors (Divo et al., 2012).

1.1 Background of the study

COPD is an illness that disturbs the lungs and airways. It's also called Chronic Obstructive Airways Disease (COAD), Chronic Airflow Obstruction (CAO) or (COLD) Chronic Obstructive Lung Disease (COLD). It's also known as Chronic Bronchitis and Emphysema (Crockett et al.,2002). COPD is a condition in which airflow constraint improves slowly and is not entirely changeable. The dissimilarity between COPD and asthma is thought-provoking for beings over the period of 40 for both medical and physical causes. COPD is a significant communal health problem.In addition to affecting severe illness and demise, COPD also upsurges the threat of severe illness and demise from other syndromes like pneumonia and flu.

The cellular pathology of (COPD) is irretrievable due to the present treatments obtainable, however, it may be treatable if the disclosure to threat factors is decreased.The temporary effects of air contamination on COPD patients in Asian municipalities have not been extensively studied (Wilson et al., 2002). Since COPD is one of the foremost causes of preventable deceases in the world, and its occurrence is on the rise, predominantly in developing countries, it has become a foremost communal health problem. In order to conduct a thorough analysis of disease burden estimation, it is essential to make informed decisions, plan, prioritise and allocate funds accordingly. Therefore, in the present study, recent data on COPD prevalence among adults in Madurai and its relationship with socio-demographic variables is collected and calculated.

1.2 Problem identification

Asthma, also known as (COPD), is a state categorized by short bursts of heavy breathing, tightness in the chest, and struggle breathing. It is initiated by a combination of ecological factors (Kale et al., 2016). Asthma is a multifaceted condition that is caused by a variety of ecological factors. In latest years, the prevalence of asthma has improved significantly in many countries around the world. The rapid rise in the number of persons with asthma cannot be described by variations in hereditary factors; therefore, the emphasis should be positioned on ecological factors. The indoor air contamination can lead to asthma attacks. Tobacco use is a threat factor for COPD (Chronic Obstructive Pulmonary Disease). Despite this, many emerging countries report great incidences of chronic lung diseases among non-smokers, which may be associated to indoor air pollution produced by solid fuel ignition.It's pretty clear from lab tests that coverage to wood smoulder can lead to COPD. It can cause bronchospasm, asthma, bronchiolitis, and fibrosis. The bereavement rate from COPD is typically around 8%, but it's tough to figure out how many publics die each year without a proper study. Hence, in the current study, we mainly focus on the impact of indoor air contaminants on COPD in

the lower respirational tract and on human health status in the city of Madurai. The goal of this study is to calculate the precision of the contaminants and the causing factors. The results of this study can be used to put in place preventive measures that will be useful to future generations to know about. It can also estimate the prevalence of COPD and the factors that cause it. This will help in reducing the mortality rates that are yet to occur.

1.3 Significance of the study

Manually (COPD) is a world-wide health dispute. COPD is instigated by infection and refashioning of airways. COPD may also lead to the growth of Emphysema.Systemic disease demonstration and acute exacerbation also disturb disease burden and threat of mortality. Extending on the old-fashioned explanations of 'pink puff' or 'blue bloomer', more recent, unbiased statistical methods support the idea that lung phenotypes are determined by body weight/body composition and are predictive of outcome self-sufficiently of lung function damage. One of the most substantial advances in nutrition has been the integration of body composition into nutrient evaluation. This has supported us to increase a better indulgent of the systemic pathophysiology of COPD and its nutritional potential.Although initially thought to be a sign of inevitable and terminal disease progression, there is now strong evidence that unintentional weight loss is not a compensatory mechanism to reduce metabolic rate in chronic obstructive pulmonary disease (COPD) but an independent survival factor, supporting weight maintenance in patient treatment.Muscle loss and reduced muscle oxidative metabolism play a significant role in poor physical performance. This provides new evidence for supplementation as an alternative to exercise training not only in the advanced disease stage but also in the early disease stage. Osteoporosis, high levels of visceral fat, and poor eating habits have been linked to COPD risk and progress, making it clear that diet and lifestyle changes are key to managing the disease, from prevention to long-term COPD.

1.4 Objectives of the study

- To evaluate the occurrence of COPD patients in health centers of Madurai
- To analyze various indoor air pollutants affecting the COPD patients in Madurai
- To evaluate the effect of contaminants on the lower respirational tract status of the COPD patients
- To recommend the suggestion to minimize the indoor pollutants for the evolution of healthy future generations

2. LITERATURE REVIEW

Clean air is important for general public to live healthy lives and support the unique ecologies of the world. The UN, which is the world's top decision-maker, has said it's a social right to have fresh air. Lots of persons in India are breathing air that's way above harmless levels, and it's producing a lot of destruction. Every year, over 7 million people in India expire from exposure to fine particulate contamination, which can lead to heart disease, lung tumour, and other lung problems. The existing paper (Kalita et al., 2019) looks at how interior air pollution disturbs women's wellbeing and how it disturbs their domestic finances. (IAP) Indoor Air Pollution is a biochemical, natural, and corporal contamination of enclosed air that could have harmful effects on health. (COPD) is a lung infection that limits the flow of air and hinders the capability to breathe. Asthma is a disorder in which the bronchi of the lungs become reddened, thinning the airways and causing respirational issues. The conventional study concluded that (Saleem et al., 2017) the Impact Assessment Programme (IAP) has been found to have an anticipated adverse impact on the health of susceptible populations, mostly women, and to disproportionately drain them economically in terms of healthcare expenditure.

The existing paper (Chellakan et al., 2022) surveys the economic influence of air contamination on socialwellbeing in India. The method (Aye et al., 2017) used is a multi-stage arbitrary sampling method for choosing the defendants. The conventional study concluded that the households with higher incomes use cleaner sources of energy like LPG and electricity, which means that those who used solid fuel in a kitchen with no partition wall were more likely to have air-related illnesses than other fuel users.

People in India are exposed to a lot of air pollution, but it's not totally clear what it's doing to their health. The existing study looks at how long-term and short-term exposure to air pollution can affect people's health, and it looks at how it affects respiratory disease, mortality, and premature death (Rajak et al., 2020).The methodology used here is meta-analysis.Air contamination is one of the biggest threats to people's fitness, causing a lot of illnesses and causing a lot of death in India. The number of people dying from ARIs in India is really high over the last few years (Singh et al., 2018). The current study concluded that spending time outdoors when Air Quality Index (AQI) exceeds a certain threshold level, as well as wearing protective clothing when necessary, can be beneficial in this regard. An operative ecological shelter organisation must have sufficient resources for management, inquiry and development, nursing and overall control of the atmosphere, containing Air Contamination Prevention and Control (APAC).

2.1 Indoor air pollution

Indoor air contamination used to get less consideration than outdoor contamination, even though indoor air contamination is typically twice as wicked and people spend 80-90% of their lives in airtight constructions (Gonzalez-martin et al., 2021). Every year, over 5 million publics don't make it to their medic's office before they die from infections caused by ruthless air quality. Not only that, but it can also cost multi-millionaires a lot of currency in lost efficiency, physical destruction, and extra costs to the fitness system.There are a lot of belongings that can contaminate the air inside your household, like atoms, microorganisms, and a bunch of different compounds. The amount of each of these belongings rest on a bunch of dissimilar things, both external and privateto your home. It’s not always likely to prevent contaminants from inflowing the atmosphere, so it's significant to have cost-effective active air contamination control units in habitation. Inappropriately, there's no one-size-fits-all equipment that can attack all interior air pollution at a good rate (Araji et al., 2018). The low absorptions, assortment and inconsistency of indoor impurities also limit the presentation of traditional PB&C technologies. Biotechnology is a great way to tackle these problems since it's low-priced and justifiable. Shrubberies, microorganisms, mushrooms, and microalgae all have the capability to act as a biocatalyst. Biological cleaning systems can help you save energy and make your constructions look better, plus they can help you feel better about yourself.

2.2 COPD: Prevalence and determinants

In sub-Saharan Africa, there's not much research on the connection between Human immune deficiency viral infection and COPD. We looked at how common COPD is and what factors affect it based on Human immune deficiency virus rank in a HIV and Tuberculosis organization centre in Cameroon (Pefura-yone et al., 2015). The determinants for COPD were studied using logistic regression models. In each of the study groups, 312 female participants were enrolled, accounting for 67.7% of the total population (Raynaud et al., 2011). Age ranged from 42.6 ages in the HIV affirmative group to 42.2 ages in the HIV destructive group, with the median being 42.1 years (standard deviation). HIV infection was linked to COPD, with the minor limit for the Forced expiratory volume/ Forced vital capacity ratio being associated with a positive outcome. In a multivariate regression analysis, COPD was most likely to be diagnosed in people with pulmonary TB, COPD-related symptoms, and a lower BMI, regardless of whether they were HIV-positive or not.

2.3 Impact of air pollutants on COPD patients

A panel of 23 healthy adults with (COPD) measured biomarkers of breathing inflammation comprising FeNO and hydrogen sulphide exhalation in the Beijing, China community from January to September 2014. Day-to-day ambient airborncontamination data was collected from neighbouring centre air nursing stations. Varied effectmock-ups were used to guess relations among contacts and health dimensions with amendment for latent confounders such as hotness and relative moistness (Wu et al., 2016). COPD is associated with higher levels of air pollution. However, COPD is not associated with a higher Adult onset Asthma prevalence. Chronic respiratory diseases are associated with higher healthcare utilization, lower quality of life, and a higher mortality rate (Shin et al., 2021). While chronic exposure to air pollution worsens a person's existing respiratory disease, its impact on asthma (or COPD) in adults (Kurt et al., 2016) has been inconclusive. In addition, only a few major studies looked at the linear (or non-linear) relationship between COPD (and adult onset asthma) related to common air pollutants.

2.4 Research Gap

- The previous study (Agusti et al,2020) investigated only how air contamination disturbs human health in countryside and metropolitan population but have not analysed the destructive impacts on the communal and throughput of the human wealth. The investigation of financial burden is inadequate to COPD and asthma, while a varied range of infections trouble females open to IAP.
- The existing study (Gonzalez et al.,2021) has not included tobacco which is also a maincontaminant in causing COPD. The necessity of conducting an in-depth empirical study to find the socio ethnic practices and anthropogenic actions in pastoral and metropolitan areas has not been satisfied.
- The existing research (Agustí, Vogelmeier, Faner, & Physiology, 2020) is based completely on subordinate data and as such, contradictions may occur within the dataset. The need of developing a valid analytical technique to investigate the change in household energy use patterns in rural and urban areas has not been found.

3. METHODOLOGY

3.1 Research Design

The framework of a methodical research is represented in study plan (Sileyew , 2019). It includes study techniques, implements, and methods to establish the research. The importance of study policy is to identify and address the difficulty that may rise in the procedure and examination of study. This research is reliant on evocative to find a analysis of study based on anexperimental research. The study includes the collection of primary data. The primary data was collected from 208 COPD patients in Madurai health centres. The current study uses the Spirometer instrument for the Collection of primary data. The Primary data composed on the survey basis, and further would be evaluated through the instrument Spirometer which evaluates associations, plans and the rate of recurrence. The result would be demonstrated in the system of graphical illustration or table presentation (figure 1)

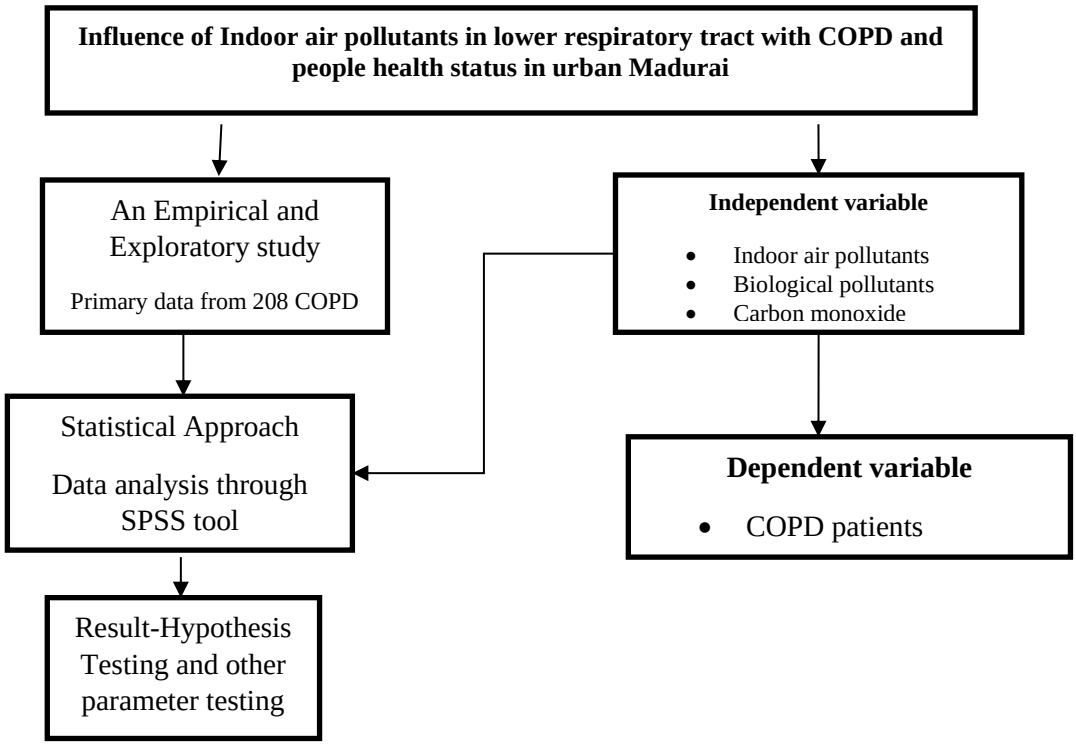

Figure 1 Research framework

3.2 Primary Data Collection

The primary data gathering is the procedure of collecting first hand data from the respondents for the research work. The procedure for collecting primary data source is accomplished through circulating the questionnaire to the respondents in the form of review or interview. The data congregated through the primary data collection method requires to be more relevant to the study variable and outcome of the data is also appropriate to the research objective. The current study incorporates primary data collection method for congregating data from208 COPD patients in Madurai. There are some techniques to gather data in the form of primary data and those techniques are in-depth interviews, questionnaire and projective data collecting.

The current study utilizes structured questionnaire for gathering primary data from 208 COPD patients in Madurai. The data congregated from primary method is more appropriate and accurate to derive the outcome of the research objective. Hence, the current study incorporated this method to know the influence of indoor air pollutants in lower respiratory tract withCOPD and people health status in urban Madurai

3.3 Sampling Techniques

Judgment sampling method was used to select the sample from the respondents. The present study utilizes the Judgement sampling method in the major data and secondary data bases which is a technique of non-probability sampling method where scholar choose who need to be joint or gained as the trial with regard to his knowledge and judgement (Thomas , 2022). The respondents selecting process is predictable to deliver

beneficial data for the study. The foremost reason for utilising purposive sampling approach is due to the declaration is created based on the goals of the study that particular people might provide considerable opinions required for the questions of the research and so necessary to be joint into the sample model (Denieffe , 2020). The trials under this purposive sampling method are acquired from the 208 COPD patients in Madurai.

3.4 Data Analysis

Quantitative analysis is designated as a systematic phenomenon through congregating data and executing computational, mathematical and statistical approaches (Jung 2019). The quantitative approach congregated data from prospective and conventional employees with aid of sampling tools and providing online survey and polls etc. The outcome of the quantitative method is determined numerically. The numerical values are interpreted and also predict the upcoming research along with appropriate changes.

The quantitative data analysis method is used for analysed data which has been gathered using structured questionnaire from sample respondents. The data are recorded utilizing Excel sheet for revealing study variables. The software tool known as SPSS is utilized for analysing the study variable in Excel sheet. The outcome of the study is estimated using five approaches known as ANOVA technique, regression, correlation and frequency analysis.

The given techniques will be applied to identify the data and verify association between the study variable of the current research. On the basis of the outcome of the study variable, interpretations will be conducted and also essential development will be recommended in the current study. With the help of SPSS software, the outcome of the current study will be efficient for documenting the study variables. The outcome will be conducted ANOVA, regression, correlation and frequency analysis in order to assess the structured hypothesis of the current study and also other tabulated value interpretation on some other related variables.

3.5 Ethical Considerations

The primary data collected was evidently for the purposes of research and would be guaranteed that the information collected is rigorously for the goal of educational and all the details would be kept private. The short period of 3-months data are taking into account for this study. It is very difficult to collect data and interpretation of Spirometer parameters.

4. RESULTS AND DISCUSSIONS

4.1 Research hypothesis

The research hypothesis of the current study is given below,

- H1: COPD patients are prevalent among people in Madurai.
- $H1_0$: COPD patients are not prevalent among people in Madurai.
- H2:.Indoor air pollutants are high in Madurai.
- $H2_0$: Indoor air pollutants are not high in Madurai.
- H3: The contaminants affects the lower respirational tract of the COPD patients.
- $H3_0$: The contaminants does not affect the lower respirational tract of the COPD patients.

4.2 Demographic data of Respondents

Table 1 Demographic data of Respondents

Demographic Factor	Parameter	No. of Respondents	Percentage (%)
Age(Yrs)	Less than 30 years	52	25%
	30 to 40 years	16	8%
	41 to 50 years	65	31%
	Above 50 years	75	36%
	Total	**208**	**100%**
Height(Cms)	Less than 100 Cms	2	1%
	100 to 150 Cms	47	23%
	Above 150 Cms	159	76%
	Total	**208**	**100%**
Sex	Male	103	49%
	Female	105	51%
	Total	**208**	**100%**
Weight(Kgs)	Less than 50 kgs	51	25%
	50-100 kgs	151	72%
	Above 100 kgs	6	3%

	Total	208	100%
Smoker	Yes	90	43%
	No	118	57%
	Total	**208**	**100%**

The table 1 represent the demographic data of the respondents who have participated in the survey. Among the 208 respondents, the majority of the respondents (COPD patients in Madurai) are above 50 years (36%). Besides, the age group of 41 to 50 years (31%) is found to be prevalent among the respondents. The age group of 30 to 40 years (8%)are found to be limited compared to other age groups. Among the patients most of them are non-smokers (57%) and some of them are smokers (43%).Based on the height, most of the respondents are above 150 Cms (76%) and only (1%) % of the respondents were less than 100 Cms and 100 to 150 Cms (23%) is prevalent among respondents. On the basis of weight, most of the respondents comes under the category of 50-100 kgs (72%) and very few of them only are of weight above 100 kgs (3%). On the basis of Gender categorization, majority of the respondents are females (51%) and comparatively male ratio (49%) have smaller differences only. The outcome of the demographic data proves that the current study has congregated data fromCOPD patients in Madurai health centres and are mainly non-smokers most of the patients are above 50 years, most of their heights are above 150 Cms with weight between 50 to 100 kgs and female COPD patients are quite greater than males.

4.3 One- way ANOVA

One-way ANOVA is utilized for determining the impact of independent factor and research objective on dependent variable and also to investigate the variation (Liang et al., 2019). The current study adopted one-way ANOVA for evaluating the prevalence of COPD patients among people in Madurai.

H1: COPD patients are prevalent among people in Madurai.

$H1_0$: COPD patients are not prevalent among people in Madurai.

Table 2 One- way ANOVA

		SOS	df	MS	F	Sig.
Age(yrs.)	Between Groups	175.998	116	1.517	1.219	0.162
	Within Groups	113.267	91	1.245	-	-
	Total	289.264	207	-	-	-
Smoker	Between Groups	31.891	116	0.275	1.305	0.093
	Within Groups	19.167	91	0.211	-	-
	Total	51.058	207	-	-	-

The table 2 illustrates the prevalence of COPD patients among people in Madurai. The outcome of the one-way ANOVA proves that the COPD patients are prevalent among people in Madurai. The outcome illustrates that p-value is 0.162 which proves that the COPD patients are prevalent among people in Madurai. Therefore, the outcome of one-way ANOVA rejects the null hypothesis.

4.4 Independent t-test

Independent T-test is regarded as a statistical test. This test is utilized for determining the impact between dependent and independent variable of study. Moreover, T-test is constantly utilized in estimating the hypothesis of study for determining the impact between two variables of the study. Hence, the present study utilizes independent t-test for determining whether indoor air pollutants are high in Madurai or not regarding COPD patients

H2: Indoor air pollutants are high in Madurai.

$H2_0$: Indoor air pollutants are not high in Madurai.

Table 3 Group Statistics

	Sex	N	M	SD	SEM
FVCTime (%) Pre	M	103	2.73	1.859	0.183
	F	105	1.99	1.973	0.193

Table 4 Independent Samples Test

		Levine's Test for EV		t-test for EM						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	MD	SE Diff	L	U
FVC(Forced vital capacity)Time (%) Pre	EV assumed	0.004	0.947	2.799	206	0.006	0.744	0.266	0.220	1.268
	EV not assumed	-	-	2.801	205.673	0.006	0.744	0.266	0.220	1.268

The table 3 and 4 represent outcome of the independent t-test regarding indoor air pollutants level in Madurai. FCV represents Forced Vital Capacity which is the total amount of air exhaled after Forced Expiratory Volume (FEV) test. The p-value of the independent t-test is 0.006 which shows that COPD patients (independent variable) are there because of high level indoor air pollutants (dependent variable). Hence, the outcome is contradict to null hypothesis

4.5 Regression analysis

Regression analysis is utilised to test the above hypothesis. Regression analysis method is utilized for analysing the association between the independent and dependent variable of the study (Astivia et al., 2019). This technique aids in evaluating the value of dependent variable from independent variable. Indoor air pollutants, Biological pollutants, Carbon monoxide, Asbestos are considered as independent variables and COPD patients are considered as dependent variable. (Table 5 and Table 6)

H3: The contaminants affects the lower respirational tract of the COPD patients.

$H3_0$: The contaminants does not affect the lower respirational tract of the COPD patients.

Table 5 Model Summary

Model	R	RS	Adjusted RS	SE of the Estimate
1	0.080[a]	0.006	0.002	0.477

a. Predictors: (Constant), FEV (3) Pre

Table 6 ANOVA[a]

Model		SOS	df	MS	F	Sig.
1	Regression	0.305	1	0.305	1.336	0.249[b]
	Residual	46.960	206	0.228	-	-
	Total	47.264	207	-	-	-

a. Dependent Variable: Wt.(Kgs.)
b. Predictors: (Constant), FEV(3) Pre

Table 7 Coefficients[a]

Model		UC		SC	t	Sig.
		B	SE	Beta		
1	(Constant)	1.853	0.069		26.933	0.000
	Forced Expiratory Volume(3) Pre	0.040	0.035	0.080	1.156	0.249

a. Dependent Variable: Wt. (Kgs.)

As demonstrated in table 7, unstandardized regression co-efficient along with regression model's constant term shows significant variation between dependent and independent variable. The outcome of the analysis illustrate that thecontaminants affects the lower respirational tract of the COPD patients. The p-value is 0.000, hence, it also demonstrates that the contaminants affects the lower respiration tract of the COPD patients. Hence, the outcome of the current study rejects the null hypothesis.

5. DISCUSSIONS

The preceding study (RahamathNisha et al., 2020) concludes that lack of using defensive measures causes respiratory disease contagion. Employees who are functioning for an extended time without any shielding measures spot respiratory contagion. Similarly, the present study found that smoking behaviours degrade the well-being of people and also categorized age group of the infect ants whose ratio are high. Furthermore, certain social and Psychological characteristics of COPD also got discussed. The existing study (Tripathi and pathak, 2019) analysed that 7 million premature decease worldwide are caused due to air pollution. Likewise the current study analysed various types of air pollutants that influences people and causes COPD. It also conducted survey among COPD patients in Madurai to know their health status. The results of the existing

study (Balamurugan, 2019) found that there is a great occurrence of Left ventricular diastolic dysfunction (LVDD) in COPD patients. Similarly, the present study evaluated the effect of contaminants on the lower respirational tract status of the COPD patients in order to find the seriousness and accuracy of the affected patients.The existing study (Kumar et al.,) concluded that commonness was considerably greater among adult males and smokers. Similarly, the present study illustrated that members with long period of Educational Testing Service and professional exposure to dirt, fumes etc. and smokers are extremely affected by COPD. The relationship among COPD and the age, smoking status are also tested.

5.1 Limitations

The main limitation of the study is that the primary data were collected only from COPD patients in Madurai health centres. Hence, the results might lack in generalizability. Acquiring airborne diseases is an ever changing module that cannot remain constant. Therefore, the outcome of the study always varies with modifications in the effects of indoor air pollutants.

5.2 COPD association with BMI index values:

The COPD is curable disease partially and associated another parameter to create COPD is BMI (Body Mass Index) parameter and their importances are represented in the form of table as well as bar char representation. The total 208 number patients are observed for this study and their BMI calculation is done with help of the primary data recorded and used the following formula:

$$BMI = (Weight(kg) / [Height(m) \times Height(m)]$$

The range selection in each category is [1-16, 16.1-17.0, 17.1-18.5,18.5-25.0, 25.1-30.0, 30.1-35.0, 35.1-40.0 and 40.0 above]. The above normal weight and their BMI index value range (18.5-25.0) value would lead the respiratory diseases and COPD. The total number patients in each category of BMI severity are mentioned as severe thinness (13), moderate thinness (12), mild thinness (9), normal (106), over weight (39), obese class-I(18), obese class-II(7) and Obese class-III (4). From the table values and graph, we understand that very less number are in the obese category and that can be reduce by suitable practice in physical activities /walking exercise in their routine life style modification.

5.3 COPD IDENTIFICATION WITH CATEGORIES

Table 8 BMI category ranges

BMI category ranges and its percentage							
1-16.0	16.1-17.0	17.1-18.5	18.5-25.0	25.1-30.0	30.1-35.0	35.1-40.0	Above 40.0
Severe thinness	Moderate thinness	Mild thinness	Normal	Over weight	Obese class-I	Obese class-II	Obese class-III
6.25	5.7	4.3	50.9	18.75	8.6	3.3	1.9

Graph 1 BMI range in percentage

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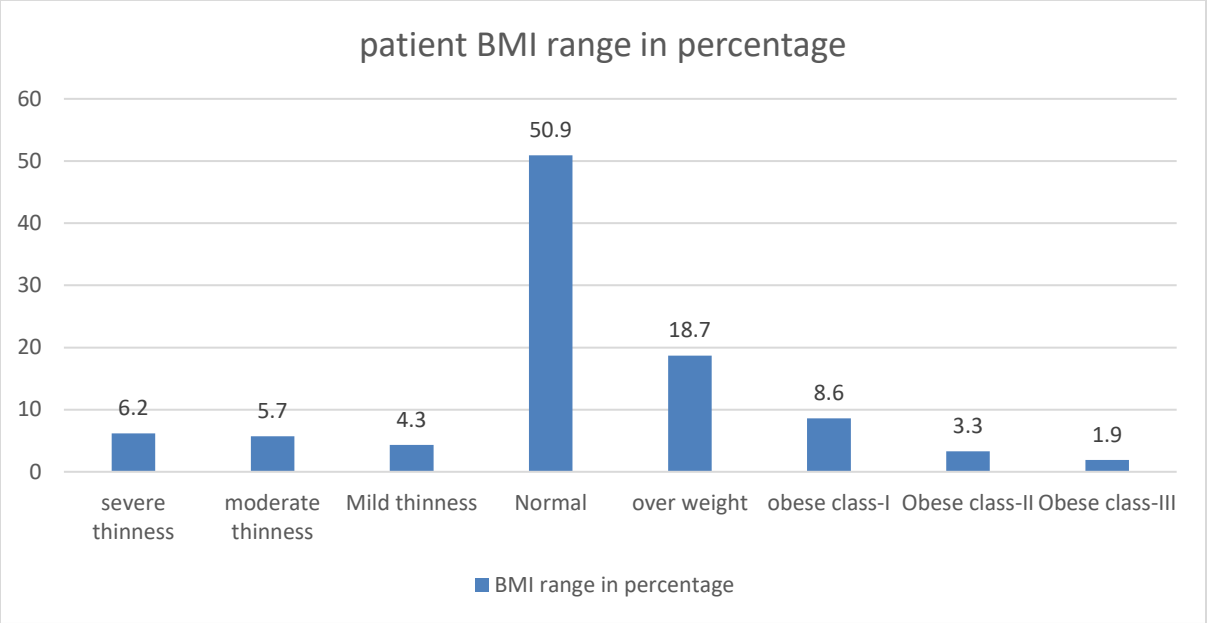
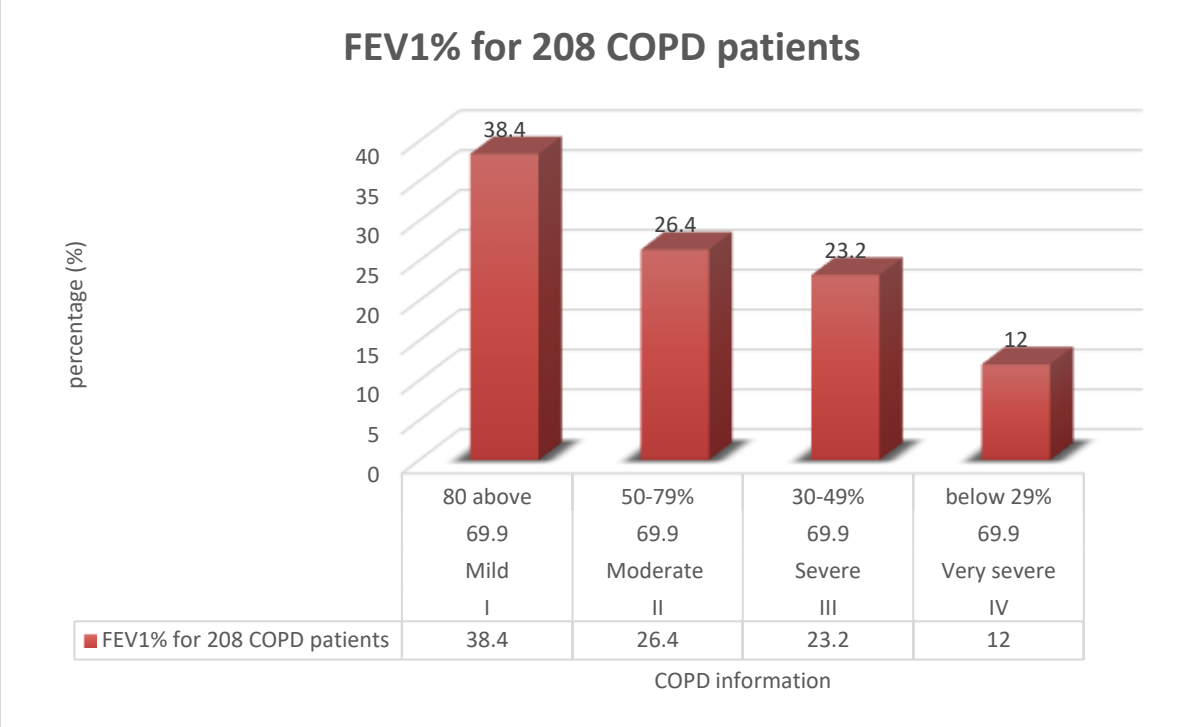


From the table 8 and graph 1 we observed that above 59% of patients are above normal stage and remain in obese category of (class-I (8.6%), Class-II (3.3%), class-III (1.9%) as per recorded. The obese category produces complicity in nature of identification of COPD.

Graph2 COPD Patient detail of FEV1% in ranges



The major category of COPD is divided into four levels. They are (GOLD stage I, GOLD stage-II, GOLD stage-III and GOLD stage-IV). The observed data are tabulated and drawn a graph for COPD identification and severity. They are indicated as (Mild, Moderate, severe and very severe) depends upon

severity. The range taken are (above 80%, 50-79%, 30-49% and below 29%) for the four categories. The patient occupy in each category was (class-I 38.4%, class-II 26.4%, class-III 23.2% and class-iv 29%) out of 208 patient respectively. In this study focus on those lived in Maduri urban area and they occupy maximum in the category of mild and moderate stage of COPD. They are treated as outpatient category in the Rajaji Government Hospital, Madurai and medicines are given in free of cost for every 30 days after complete examination.

The remaining category, that is less in percentage occupy the Moderate, severe and very severe category are treated as in patient and admitted in the hospital depends on their severity from one week to one month time period.

Hospital treatment:

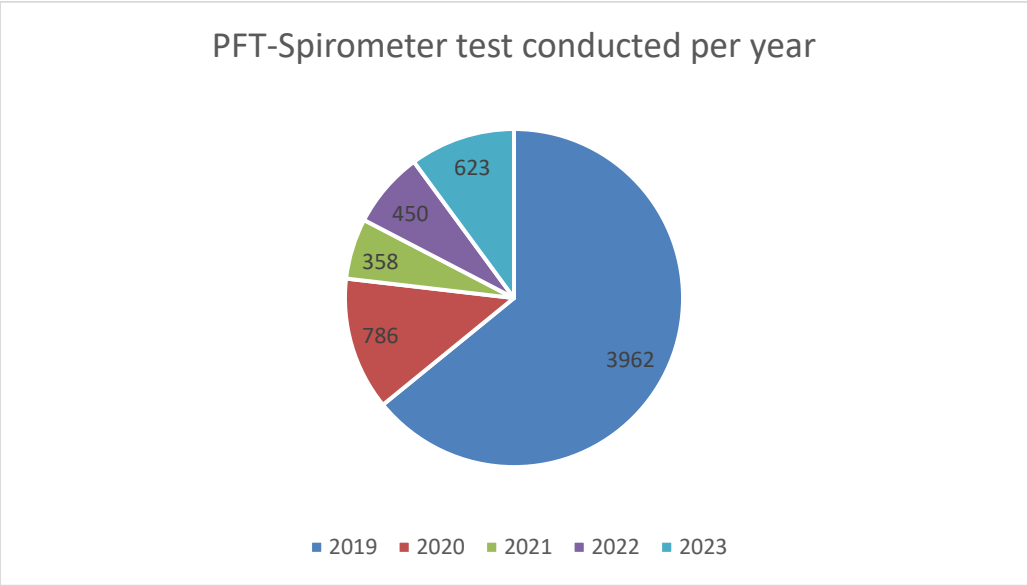
The treatment given in the inpatient hospital includes medicine that is tablet, and inhalers and healthy food. Some special cases needed operation, that is removal of damaged lung portion at minimum level to transplant level depends on patient condition. The X-ray and CT scan are taken further to know the severity of COPD during before and after a treatment

The treatment includes medicine that is tablet, and inhalers and healthy food. Some special cases are needed operation, that is removal of damaged lung portion at minimum level to transplant level depends on patient condition.

The x-ray and CT scan are taken in Rajaji government hospital they are charged as RS.5000/- under health insurance scheme implemented by Tamil Nadu government, Tamil Nadu. The DLCO (diffusing capacity of carbon monoxide) also carried out as a part of the examination

The number of pulmonary function test (PFT) taken in a year are mentioned against number of patient and a graph-3 is drawn for it. The DLCO (diffusing capacity of carbon monoxide test) was carried out in different years are mentioned in graph-4 and drawn a graph to identify the COPD severity in Madurai urban area.

Graph 3 COPD-Spirometer test conducted in Madurai Rajaji Hospital, Madurai



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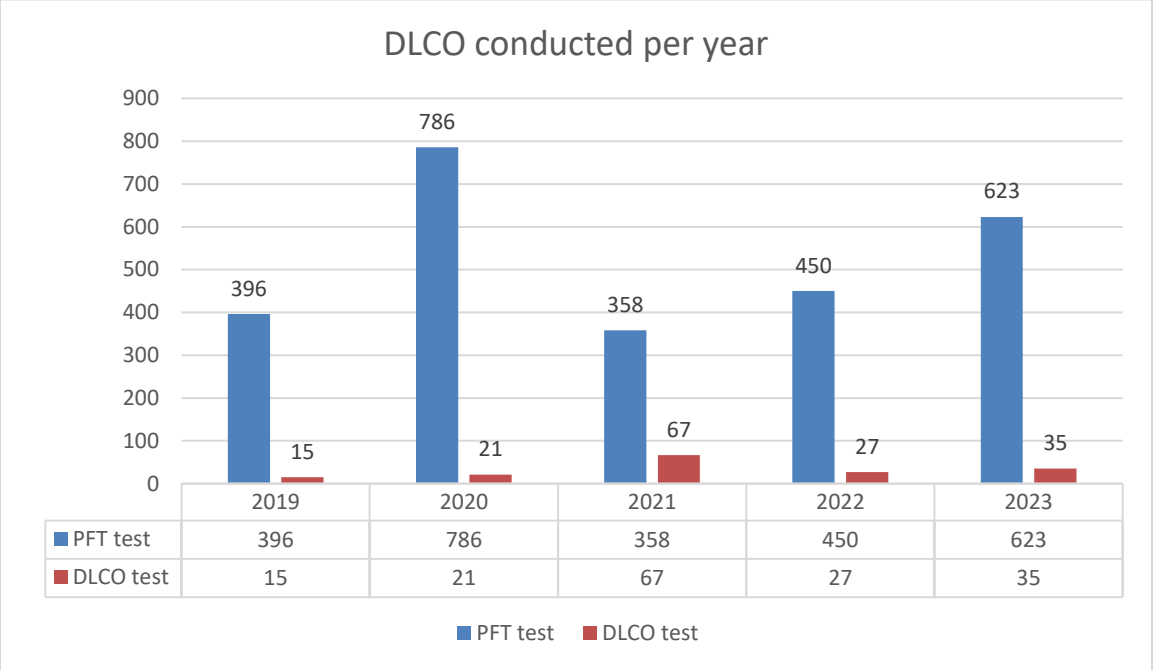
Graph 4 COPD-DLCO test conducted in Madurai Rajaji Hospital, Madurai



6.CONCLUSION

Contact to dense fuel smoke is constantly and considerably associated with COPD death and COPD occurrence in Madurai urban area is increased from 9% to 12% in every year due to increase of cigarette smoker in numbers and indoor air pollution increased level in urban areas, Tamil Nadu state, India. For performing local tasks, inventiveness should be taken to less reliance on hard fuel through using home help alternatives. In recent days the LPG gas used as an alternative fuel against country wood fuel in urban areas and obtained in the percentage of usage in the level of 85% maximum. The remaining percentage will be obtained through people awareness programmes in the next 5 years. The poverty is another major factor that will be reduced further in these areas by introducing more job opportunities. Increased Inhalation of air contaminants could annoy the respiratory tracts and might reduce asthma episodes, breath rate, and chest pain, wheezing and coughing.

Disclosure to air contamination will cause risk for lung tumour, heart assaults, stroke and premature decease. Sufficient aeration is important in endorsing healthy inside air, and opening holes-in-the-wall. It is a cool way to inspire a good interchange of inside and outside mid-air. Cigarette smoking damages respiratory healthiness and is already accountable for around 3,000 lung tumour deceases per annum in non-smokers. An air cleanser alone would not eliminate all the filths of indoor air. However, if the struggle to have allergens and further contaminants out of home occurs, an air cleanser can aid to decrease them additionally.

Future study:

The present study tested the occurrence of COPD patients in Madurai. It also analyzed various indoor air pollutants that are affecting the COPD patients. Our findings evaluated the effect of contaminants on the lower respirational tract status of the COPD patients and also recommended various suggestions to reduce the indoor pollutants for the evolution of healthy future generations. In future research, the study will expand

and analysis will be made in various locationsin studying Behavioural and Psychological aspects of disease, control and preventive measures.

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